THE PHILIPPINE, CHINESE, AND INDO-CHINESE SPECIES OF THE GRASS GENUS GARNOTIA BRONGNIART[1]

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With two plates and one text-figure

The original plan of the writer was to make a critical study of all the species of *Garnotia* and to prepare a monograph of the genus. The presence of several polymorphic species, however, demands a more intensive investigation of a larger number of collections than available at present and, especially, a careful study of the type specimens. The species are so extremely variable that it is impossible to define them accurately without access to additional material. The variations include primarily the great diversity in the size and pubescence of the leaves and in the length and insertion of the awns of the spikelets. Thirty-eight species and seven varieties have been described. The type specimens of 11 of these are in the segregated type collections of the U. S. National Herbarium, which are not accessible for the duration of the war. Since it is impossible to borrow specimens from foreign herbaria or to visit them, it is necessary to confine the present work to the species of the Philippines, China, and Indo-China, from whence there is sufficient material available for study. All accessible types, duplicate types, or topotypes of the species treated in this paper were examined. In all cases the original descriptions were consulted. The present treatment includes eight species and two varieties, of which three species and one variety are described as new.

This study is based on the collections in the U. S. National Herbarium, supplemented by specimens borrowed from other institutions. The following abbreviations are used in designating the herbaria in which the cited specimens are deposited: (NH) United States National Herbarium, (NY) Britton Herbarium of New York Botanical Garden, (G) Gray Herbarium of Harvard University, (UM) Herbarium of the University of Michigan, (UC) Herbarium of the University of California, and (AS) Herbarium of the National Research Institute of Biology, Academia Sinica, Nanking, China.

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Synonymy and Relationships

Garnotia Brongn. in Duperrey, M. L. I., Voyage Autour du Monde

[1]Papers from the Department of Botany of the University of Michigan, no. 732.

2(2): 133. *pl. 21.* 1830. The genus and a single species, *G. stricta* Brongn., are described and figured with a full-page illustration showing the habit of a flowering plant and the structure of the spikelet.

Miquelia W.-Arn. & Nees, Nov. Act. Acad. Caes. Leop. Carol. Nat. Cur. **19:** Suppl. 1: 177. 1841. A generic description is given and three species are included: *M. barbulata* Nees (p. 178), *M. Emodi* W.-Arn. & Nees (p. 178), and *M. courtallensis* W.-Arn. & Nees (p. 179). The incomplete diagnosis of *M. barbulata* must have been based on fragmentary material, for in presenting the structure of the spikelet, the first glume was described, then it was stated that "Reliquas partes fructificationis explicare non potui." Since no collection was cited, it seems best to consider this as a *species dubia* until it is interpreted by an adequate specimen. In *M. Emodi,* the straight, erect awn of the lemma is a deviation from the generic description which specifies that the short-bidentate apex of the lemma "emittens aristam (setam) infra medium geniculatam et tortilem." *M. courtallensis,* the last species, agrees well with the generic description, hence it is taken as the type species.

There is no indication that Walker-Arnott and Nees were aware of *Garnotia* Brongn. when they described *Miquelia,* for no reference was made to it. An analysis of the description of *Miquelia* W.-Arn. & Nees shows that its characters agree with those of *Garnotia* Brongn. The transfer to *Garnotia* of the three species originally described under *Miquelia* is clearly justified: *G. barbulata* (Nees) Merr. Philip. Jour. Sci. Bot. **13:** 130. 1918, *G. Emodi* (W.-Arn. & Nees) Janowski in Mez, Repert. Sp. Nov. **17:** 86. 1921, and *G. courtallensis* (W.-Arn. & Nees) Thwaites, Enum. Pl. Zeyl. 363. 1864. *Garnotia barbulata,* however, must be considered temporarily as a *species dubia.* Dr. Keng refers it doubtfully to *Arundinella setosa* Trin. as a synonym.[2]

Berghausia Endl. Gen. Pl. Suppl. **3:** 57. 1843. "Miquelia Nees in Plant. Meyen. 177," the only citation, refers to a specimen, not to a publication. The generic description agrees well with that of *Miquelia* W.-Arn. & Nees. No species were here transferred by Endlicher. Probably unaware of *Garnotia* Brongn., Endlicher must have proposed the genus *Berghausia* on the ground that the name *Miquelia* had been previously applied to two other genera, *Miquelia* Meissn. Gen. 152. 1838, and *Miquelia* Blume, Bull. Neerl. **1:** 94. 1838. Since the publication of *Berghausia* Endl. involves only a change in nomenclature, maintaining the generic concept of *Miquelia* W.-Arn. & Nees, the type species of *Miquelia, M. courtallensis* W.-Arn. & Nees, is retained for *Berghausia* Endl. Following the concept of Endlicher, Miquel[3] published six species of *Berghausia,* each of which was based on a species of *Miquelia.* Endlicher is given as the author of *B. barbulata, B. Emodi,* and *B. courtallensis.* All the species published under *Berghausia* have been transferred to *Garnotia* Brongn.

[2]Keng, Y. L., Nat. Cent. Univ. Science Reports, Biology **2:** 56. 1936.

[3]Miquel, F. A. G., Verh. Nederl. Inst. III. **4:** 32. 1851.

In 1855 Steudel[4] recognized *Garnotia*, but at the same time he considered *Miquelia* W.-Arn. & Nees as a separate genus with *Berghausia* Endl. as a synonym. The first treatment of *Garnotia* as it is now accepted is that of Bentham,[5] who considered it as a valid genus with both *Miquelia* W.-Arn. & Nees and *Berghausia* Endl. as synonyms. Following Bentham's treatment, the genus was similarly recognized in the floristic studies of Asia, among the most prominent of which are those by Thwaites,[6] Hooker,[7] Trimen and Hooker,[8] Cook,[9] Merrill,[10] and Ridley.[11]

The 1-flowered spikelets, subterete to dorsally compressed, and disarticulating below the glumes, misled the earlier authors as to the taxonomic position of the genus. Brongniart states that it is near *Paspalum;* Walker-Arnott and Nees place it in Tristegineae, and Endlicher in Paniceae. Steudel places both *Garnotia* and *Miquelia* in Paniceae. Bentham places *Garnotia* in Tristegineae. Thwaites does not indicate the tribes but places *Garnotia* next after *Arundinella* Raddi. Hooker was the first to recognize the affinity of *Garnotia,* in spite of its anomalous characters, placing it in Agrostideae, and he has been followed by subsequent authors.

Garnotia Brongn.

Spikelets 1-flowered, lanceolate to narrow-lanceolate, subterete to dorsally compressed, disarticulating below the glumes, pubescent at the base, solitary or in pairs, the members of each pair with unequal (usually short) pedicels; rachilla not produced behind the palea; glumes often rigid, unequal, acute to acuminate, awned or awnless, 3-nerved, the nerves scaberulous to scabrous; lemma firm or membranous, 1- or 3-nerved, awned (rarely awnless) from the entire, notched, or bidentate apex, the awn slender, erect, straight, flexuous, bent, or geniculate and twisted toward the base, or tortuous toward the tip; palea membranous, enclosing a bisexual flower, faintly 2-nerved, keeled along the nerves, the margins auricled below the middle; lodicules 2, minute, glabrous or fimbriate.

Annual or perennial grasses with simple or branched culms, flat or involute blades, and open to contracted panicles.

Type species: *G. stricta* Brongn. Described from Tahiti.

This species has been repeatedly reported in floras of several regions in Asia and the islands of the Pacific. During the preparation of this paper, an intensive study was made of the numerous specimens from the regions mentioned which had been determined as *G. stricta*. The writer, guided by the original description and plate of Brongniart, came to the conclusion that the only collections which represent the species are those of Peter

[4]Steudel, E. G., Syn. Pl. Gram. 119. 1854, Add. et Emend. 417. 1855.

[5]Bentham, G., Fl. Hongk. 416. 1861.

[6]Thwaites, G., Enum. Pl. Zeyl. 363. 1864.

[7]Hooker, J. D., Fl. Brit. Ind. **7**: 241. 1896.

[8]Trimen and Hooker, Handb. Fl. Ceyl. **5**: 253. 1900.

[9]Cook, T., Fl. Pres. Bomb. **2**: 1012. 1908.

[10]Merrill, E. D., Enum. Philip. Fl. Pl. **1**: 81. 1925.

[11]Ridley, H., Fl. Malay Pen. **5**: 242. 1925.

Nelson (*359* and *430*) from the island of Guam. Of the six collections from the Philippines cited by Merrill[12] as belonging to *G. stricta*, the following duplicates were examined: *Elmer 6210* and *6989; Merrill 3903, 4716*, and *5484*. Careful study of the specimens shows that none of them can be identified as *G. stricta*. Merrill[12] himself stated that, "The Philippine form of *Garnotia* may represent a distinct species, characterized specially by the long-awned flowering glume."

Garnotia is distributed from eastern and southern Asia to the Pacific Islands, at low to high altitudes. There are about 30 species, three from the Philippines, five from China, three from Indo-China, and the rest from the other localities of its range.

KEY TO THE SPECIES AND VARIETIES

A. Lemma long-awned.
  B. Awn of lemma geniculate, twisted below the bend.
    C. Glumes papillose-pilose .....1. *G. ciliata.*
  CC. Glumes glabrous.
    D. Mature blades conduplicate, falcate to subarcuate. .....
      .....1a. *G. ciliata* var. *conduplicata.*
    DD. Mature blades flat. .....2. *G. fragilis.*
  BB. Awn of lemma erect, not twisted.
    C. Branches of mature panicles stiffly spreading. .....3. *G. patula.*
  CC. Branches of mature panicles loosely appressed or sometimes strict.
    D. Both glumes long-awned, the awn 3–5 mm. long.
      E. Culms erect, 20–40 cm. tall. .....4. *G. triseta.*
      EE. Culms decumbent, rooting at the lower nodes, 45–90 cm. tall. .....
        .....4a. *G. triseta* var. *decumbens.*
    DD. Both glumes short-awned to awnless, rarely one glume long-awned.
      E. Awn of lemma stiff, straight to weakly flexuous from the base to the tip. .....5. *G. caespitosa.*
      EE. Awn of lemma stiff, straight to weakly flexuous to above the middle, capillary, strongly flexuous or tortuous, usually drooping toward the tip, the tortuous part sometimes deciduous at maturity. .....
        .....6. *G. mindanaensis.*
AA. Lemma awnless.
  B. Branches of mature panicles spreading, the pairs of spikelets distant. .....
    .....7. *G. mutica.*
  BB. Branches of mature panicles loosely appressed, the pairs of spikelets approximate. .....8. *G. philippinensis.*

1. **Garnotia ciliata** Merr. Philip. Jour. Sci. Bot. **13:** 130. 1918.

Perennial, 25–40 cm. tall; culms usually ascending from a decumbent base, sometimes rooting at the lower nodes, glabrous, the nodes pubescent; sheaths papillose-pilose, mostly longer than the internodes; collar glabrous or nearly so; ligule about 0.5 mm. long, the margin minutely erose, ciliolate; blades 8–11 cm. long, 5–8 mm. wide, flat, narrow-lanceolate, acuminate, tuberculate-pilose with long hairs on both surfaces, the margins wavy, scaberulous and tuberculate-ciliate; panicles to 13 cm. long, occasionally longer; branches strict, up to 6 cm. long, in fascicles or those near the summit paired to solitary; spikelets dorsally compressed, about 6 mm. long and 1 mm. wide, narrow-lanceolate, bearded around the base, in pairs, the short, unequal pedicels angular, scaberulous; glumes equal or subequal,

[12]Merrill, E. D., Philip. Jour. Sci. Bot. **1:** Suppl. 374. 1906.

acuminate, short-awned, sparsely pilose with long, soft hairs; lemma slightly shorter than the glumes, narrow-lanceolate, hyaline, glabrous, faintly 1- to 3-nerved, awned from the bidentate apex, the awn about twice as long as the spikelet, geniculate near the base, twisted, smooth, brown below the bend, the rest straight, scaberulous, pale; palea shorter than the lemma, narrow, the margins auricled toward the base, sparsely puberulent from the auricles to the tip; lodicules membranous, cuneate, glabrous.

TYPE AND LOCALITY: "Loh Fau Mountain (Lofaushan), *Merrill 10701*, August 25, 1917, on thin earth over boulders along streams, altitude 900 to 1,000 meters."

CHINA: Kwangtung: Loh Fau Mountain, roadside, *McClure & Levine* (Cant. Christ. Coll. no. *6928*), Aug. 31 – Sept. 4, 1921 (NH; G, photograph only); moist place on rocks near summit, *Hitchcock 19009*, Oct. 26–29, 1921, taller plant with broader and longer leaves (NH).

1a. **Garnotia ciliata** Merr. var. **conduplicata** var. nov.

Annua; vaginae papilloso-pilosae; laminae ad maturitatem conduplicatae, falcatae vel subarcuatae; paniculae usque ad 15 cm. longae; spiculae eis speciei similes sed glabrae.

Annual; culms erect or ascending; sheaths papillose-pilose, the hairs mostly deciduous; blades at maturity conduplicate, falcate to subarcuate, with hairs similar to those of the sheaths; panicles up to 15 cm. long, the branches strict; spikelets about 5 mm. long, similar to those of the species but glabrous.

TYPE in the U. S. National Herbarium, no. 1106724, collected on moist place on rocks near the summit of Loh Fau Mountain, Kwangtung, China, Oct. 26–29, 1921, by A. S. Hitchcock, no. *19009½*. Another specimen from Kwangtung is Cant. Christ. Coll. no. *10547*, Oct. 28, 1921 (NH). No collector nor particular locality is indicated.

The habit is identical with that of the species but the variety differs in that most of the hairs of the leaves are deciduous, leaving the papillae only; the mature blades are conduplicate, falcate to subarcuate, and the spikelets are glabrous.

2. **Garnotia fragilis** sp. nov. PLATE I.

Annua; culmi simplices vel pauciramosi, nodis pubescentibus; vaginae compressae, carinatae, non crebrae; laminae 6–15 cm. longae, 5–12 mm. latae, planae, utrinque papilloso-pilosae; paniculae laxae, saepe fragiles, infirme flexuosae; spiculae e dorso compressae, 3–4 mm. longae, 0.5–0.6 mm. latae; lemma pallidum, anguste lanceolatum, glabrum, 1-nerve, inter lobos aristatum, arista lemmate 2–3-plo longiore, geniculata, infra geniculum torta.

Annual; culms up to 36 cm. tall, sparingly branched, erect or sometimes ascending and rooting at the lower nodes, glabrous, the nodes pubescent; sheaths compressed, keeled, sometimes sparsely ciliate along the margins, otherwise glabrous; collar glabrous; ligule about 0.5 mm. long, membranous, ciliolate; blades of the basal leaves much reduced, those of the upper 6–15 cm. long, 5–12 mm. wide, flat, narrow-lanceolate, acute to acuminate, sparsely papillose-pilose on both surfaces, the hairs on the upper surface near the ligule about 4 mm. long, the nerves and the wavy margins weakly scaberulous, the bases usually narrow; panicles lax, partly included in the uppermost sheaths, interrupted toward the base; main axis angled, scabrous; branches up to 7 cm. long, often fragile, weakly flexuous, ascending or loosely appressed, fascicled at the lower nodes, paired to solitary toward

the tip; spikelets dorsally compressed, 3–4 mm. long, 0.5–0.6 mm. wide, narrow-lanceolate, pubescent at the base, in pairs, the unequal pedicels about ¼ and ½–¾ as long as the spikelets respectively; first glume slightly shorter than the second, both scaberulous on the nerves, sparsely so on the internerves, awned from the notched or shortly bidentate apices, the awns up to ⅘ as long as the glumes, the awn of the first glume usually slightly shorter than that of the second; lemma pale, equaling the second glume, narrow-lanceolate, glabrous, faintly 1-nerved, the margins hyaline, awned from the bilobed apex, the lobes narrow, obtuse, the awn 2–3 times as long as the lemma, sometimes longer, geniculate toward the base, brown and twisted below the bend, the rest lighter in color, straight to weakly flexuous, antrorsely scaberulous; palea much shorter than the lemma, membranous, the margins auricled toward the base, sparsely soft-pubescent from the auricles to the tip; lodicules cuneate, glabrous.

TYPE in the U. S. National Herbarium, no. 1610035, collected along a path through humid forest at an elevation of about 2000 meters, in the vicinity of Chapa, Lo Qui Ho, Indo-China, September, 1933, by A. Pételot, no. *4745*. A duplicate type is in the Britton Herbarium, New York Botanical Garden, and another is in the possession of the writer, to be deposited in the herbarium of the University of the Philippines, Manila. *A. Pételot 5058* (NH) and *5068* (NH, NY), collected from the type locality and its vicinity, also belong to this species.

The specific epithet alludes to the characteristic fragility of the branches of the panicles, which break off easily.

While this species shows affinity to the Indian *Garnotia polypogonoides* Munro,[13] it is distinguished from that by the following characters: culms sparingly branched; basal sheaths not crowded and overlapping, the blades papillose-pilose on both surfaces; panicles lax, partly included in the uppermost sheaths, the branches often fragile, weakly flexuous; mature lemma pale.

3. **Garnotia patula** (Munro) Benth. Fl. Hongk. 416. 1861.
Berghausia patula Munro, Proc. Amer. Acad. **4:** 362. 1860.
Garnotia drymeia Hance, Ann. Sci. Nat. IV, Bot. **18:** 233. 1862. Described from Hongkong (Hance Herb. propr. no. 8668), collector not given.
Garnotia Poilanei A. Camus, Bull. Mus. Hist. Nat. Paris **27:** 456. 1921. Described from Cambodia, *Poilane 271*.

Perennial; culms 30–80 cm. tall, tufted, erect, simple, glabrous, the nodes glabrous to short-pubescent; leaves mostly basal; sheaths glabrous to sparsely pilose; collar densely pubescent; ligule membranous, 0.2–0.5 mm. long, ciliate to pilose; blades 15–40 cm. long, 4–12 mm. wide, linear-lanceolate, acute to acuminate, glabrous to sparsely tuberculate-pilose, the margins weakly scabrous; panicles compound, 15–40 cm. long, the branches stiff, widely spreading, as much as 11 cm. long, fascicled toward the base, paired to solitary toward the summit; spikelets dorsally compressed, 4–4.5 mm. long, lanceolate to narrow-lanceolate, pubescent around the base, in pairs, one pedicel short, the other up to about as long as the spikelet; glumes equaling the spikelets, acute to acuminate, short-awned or sometimes long-awned, the nerves scaberulous; lemma as long as the glumes, glabrous, 3-nerved, acuminate, awned, the awn 7–13 mm. long, weakly scabrous, straight or slightly wavy; palea membranous, the margins auricled toward

[13]Munro ex Oliver in Hook. Icon. Pl. **5:** 64. *pl. 1484*. 1885.

the base, soft-pubescent from above the auricles to the tip; lodicules spatulate-cuneate, glabrous.

TYPE AND LOCALITY: "Hong Kong." Collected by Charles Wright (U. S. North Pac. Expl. Exped. 1853–56). No collector's number given.

CHINA: Kwangsi: Po Yam Shan (along Kwangtung border), near Tai Chung village (Sun-to District), *Tsang 22968,* Oct. 12, 1933 (G); Tou Ngok Shan (along Kwangtung border), near Tung Chung village (Waitsap District), *Tsang 23271,* Nov. 24, 1923 (G); Se Tze Shan (along Kwangtung border), near Tung Chung village (Waitsap District), *Tsang 23326,* Dec. 4–6, 1933 (G); Kwangtung: Loh Fau Mountain, 20 miles north of Sheklung, in moist place on rock slide above monastery, *Hitchcock 19049,* Oct. 26–29, 1921 (NH); Canton, White Cloud Mountain and vicinity, along small stream, *Hitchcock 18909,* Oct. 24, 1921 (NH); above Canton, at summit of Pakwan Mountain, Hance Herb. no. *9668,* Oct. 8, 1869, collector not indicated (G); Hainan, *Chow 73545,* 1935, an exceptionally tall and robust plant (G); opening in woods on Kachek River 25 miles above Kachek, *Hitchcock 19628,* Oct. 13, 1921 (NH); Hongkong: *Wright* (U. S. North Pac. Expl. Exped.), 1853–56 (G, ISOTYPE); Hance Herb. no. *1009,* Oct. 1859, no collector given (G); Road to Victoria Peak, shady slope below hotel, *Hitchcock 19133,* Nov. 5, 1921 (NH). INDO-CHINA: Tonkin: "Bord des chemins en forêt, Massif du Tom Dao," alt. 1000 m., *Pételot 3839,* Nov. 1930 (NH, NY).

4. **Garnotia triseta** Hitchc. Lingn. Sci. Jour. **7:** 200. 1931.

Perennial; culms 20–40 cm. tall, tufted, erect, simple, glabrous, the nodes pubescent; leaves mostly basal; sheaths glabrous or the throat sparsely pilose; collar short-pubescent to pilose; ligule membranous, 0.2–0.3 mm. long, minutely erose, ciliolate; blades 5–13 cm. long, 2–4 mm. wide, linear-lanceolate, acute to acuminate, sparsely pilose on the upper surface, glabrous on the lower, the margins weakly scaberulous; panicles narrow, 10–15 cm. long (rarely much longer), the main axis and branches scabrous, the latter appressed or slightly ascending, in fascicles of 3's at the lower nodes, paired to solitary toward the summit; spikelets dorsally compressed, 3–4 mm. long, about 0.8 mm. wide, narrow-lanceolate, pubescent around the base, in pairs, one pedicel short, the other about as long as the spikelet; glumes equal or subequal, the nerves scabrous, the tips acute, extending into an awn 3–5 mm. long; lemma as long as the glumes, glabrous, acute to acuminate, terminating in a slender, scaberulous, straight or slightly wavy awn 8–15 mm. long; palea membranous, the margins auricled below the middle, sparsely soft-pubescent from above the auricles to the tip; lodicules membranous, spatulate-cuneate, glabrous.

TYPE AND LOCALITY: "Type in the U. S. National Herbarium, no. 1106729, collected in moist shady place along stream on Lohfau Mountain, Kwangtung Province, China, Oct. 28, 1921, by A. S. Hitchcock (no. *19003*)."

CHINA: Kwangtung: Loh Fau, *Levine* (Lingn. Univ. Herb. no. *10234*), Oct. 28, 1921 (NH); Loh Fau Mountain, 20 miles north of Sheklung, moist shady place along stream, *Hitchcock 19003,* Oct. 28, 1921 (NH, ISOTYPE); Teng Woo Mountain, *Levine* (Cant. Christ. Coll. no. *69*), Nov. 19, 1916 (NH, paratype); Kwangsi: Tonghan (along Kwangtung border), near Sap-luk Po village (Waitsap District), *Tsang 22775,* Sept. 14, 1933 (G).

4a. **Garnotia triseta** Hitchc. var. **decumbens** Keng, Sunyatsenia **3:** 18. 1935.

Culms 45–90 cm. tall, 2–3 mm. thick, ascending from a decumbent base, rooting at the lower nodes; blades as much as 35 cm. long and 8 mm. wide; panicles 20–40 cm. long, the branches erect-ascending, as much as 15 cm. long; spikelets about 4 mm. long, similar to those of the type.

The foregoing description is a translation from the original Latin diagnosis, no specimen being available for examination.

TYPE AND LOCALITY: ". . . collected by the side of a stream, Sunyi, Kwangtung, China, August 12, 1931, by C. Wang (no. *31157*)" (AS).

5. **Garnotia caespitosa** sp. nov. PLATE II.

Perennis; culmi usque ad 40 cm. alti, caespitosi, nodis pubescentibus; vaginae glabrae, marginibus in parte superiore ciliatis, collari pubescente; laminae 5–12 cm. longae, circa 2 mm. latae, utrinque papilloso-pilosae; paniculae 10–20 cm. longae, angustae; spiculae 3–4.5 mm. longae, circa 0.5 mm. latae; glumae subaequales, breviter aristatae; lemma anguste lanceolatum, 3-nerve, apice acuminatum, integrum, arista tenui, erecta, rigida, recta vel paullum flexuosa ad apicem non tortuosa, 10–15 mm. longa.

Perennial; culms up to 40 cm. tall, caespitose, slender, erect, or sometimes slightly ascending from the base, simple, or occasionally branching and rooting at the pubescent nodes; internodes glabrous; sheaths with prominent veins, ciliate along the upper part of the margins, otherwise glabrous; collar pubescent; ligule membranous, about 0.3 mm. long, ciliolate; blades 5–12 cm. long, about 2 mm. wide, flat, sometimes becoming involute at maturity, papillose-pilose on both surfaces except for the glabrous base of the upper surface, the margins weakly scaberulous, gradually becoming smooth toward the base, the tips acuminate; panicles 10–20 cm. long, narrow, the main axis and branches smooth or nearly so, the latter in fascicles of not more than 3 at the lower nodes, paired to solitary toward the apex; spikelets dorsally compressed, 3–3.5 mm. long, about 0.5 mm. wide, lanceolate to narrow-lanceolate, pubescent at the base, the hairs 0.5 mm. long, in pairs, the strongly unequal pedicels angular, glabrous; glumes subequal, the nerves scaberulous, gradually becoming smooth from middle to base, the internerves glabrous, the tips acute to acuminate, short-awned; lemma as long as the second glume, narrow-lanceolate, narrowed toward the base, thinly coriaceous, rounded on the back, faintly 3-nerved, glabrous, acuminate, entire, awned, the awn scaberulous, slender, stiff, straight or weakly flexuous from the base to the tip, 10–15 mm. long; palea shorter than the lemma, narrow-lanceolate, membranous, the margins auricled below the middle, sparsely soft-pubescent from above the auricles to the tip; lodicules spatulate-cuneate, glabrous.

TYPE in the U. S. National Herbarium, no. 1238135, collected at Los Baños, Laguna Province, Luzon Island, Philippines, March 6, 1913, by F. C. Gates (no. *6237*) (NH).

PHILIPPINES: *Philip. Bur. Sci. 14209* (no collector nor locality given) (NH); Luzon: Isabela Province, San Mariano, *Ramos & Edaño* (Philip. Bur. Sci. *47127*), Feb.–Mar. 1926 (NH, NY); Mountain Province, Benguet, Sablan, *Elmer 6210*, April 1904 (NH, NY); Benguet, Baguio, *Elmer 8898*, Mar. 1907 (NH, NY); Bulacan Province, Angat, *Ramos & Edaño* (Philip. Bur. Sci. *34069*), Feb. 1919 (UC); Laguna Province, *Catalan* (Philip. Bur. For. *26465*), Feb.–Mar. 1917 (NH); San Antonio, *Ramos* (Philip. Bur. Sci. *20403*), Feb. 1913 (NH); Mt. Banajao, *Robinson* (Philip. Bur. Sci. *9763*), Mar. 5–7, 1910 (NH, NY); Mindanao: Zamboanga Province, Malangas, *Ramos & Edaño* (Philip. Bur. Sci. *36776*), Oct.–Nov. 1919 (NH); Isabela de Basilan, *Ebalo 907*, Jan. 5–18, 1941 (UM). CHINA: Kwangtung: Canton, Ting-u Shan, at the base of running water, *Sampson* (Herb. Hance no. *8135*[?]), Oct. 1867 (G). INDO-CHINA: Tonkin: Chapa, on rocks by the side of stream, alt. 1500 m., *Pételot 3253*, Jan. 1928 (NH, NY).

This species is closely related to *Garnotia mindanaensis* Santos, differing

chiefly in the erect, rigid, straight or weakly flexuous awn of the lemma, and in the plainly evident hairs at the base of the spikelets.

6. **Garnotia mindanaensis** Santos, Jour. Wash. Acad. Sci. **33:** 135. *f. 1.* 1943.
Garnotia stricta Brongn. var. *longiseta* Hack. in Kneucker, Allgem. Bot. Zeitschr. **15:** 141. 1909. Described from Mt. Mariveles, Bataan Province, Luzon, Philippines.

Perennial, 45–55 cm. tall; culms simple, tufted, erect or slightly geniculate toward the base, glabrous, the nodes pubescent; sheaths glabrous to short-pilose, the veins prominent; collar pubescent; ligule about 0.2 mm. long, glabrous to ciliolate; blades 8–25 cm. long, 3–10 mm. wide, linear-lanceolate, flat, glabrous to short-pilose, the margins scaberulous; panicles 10–28 cm. long, narrow, interrupted, the branches loosely appressed; spikelets dorsally compressed, 4–4.5 mm. long, 0.5–0.6 mm. wide, narrowly lanceolate, with very short hairs at the base, in pairs, the pedicels short, unequal; glumes subequal, the nerves scaberulous to scabrous, the internerves glabrous, the tips short-awned (sometimes awnless); lemma at maturity equaling the glumes, lanceolate, glabrous, 3-nerved, acute, awned, the awn 1–2.5 times as long as the lemma, erect, rigid, straight or weakly flexuous to above the middle, capillary, strongly flexuous to tortuous toward the tip, the tortuous part sometimes drooping or deciduous at maturity; palea narrowly lanceolate, the margins auricled toward the base, soft-pubescent from above the auricles to the tip; lodicules spatulate, glabrous.

Since the publication of the original description of this species, numerous specimens of *Garnotia* from the Philippines have been studied. After examining about 25 collections which were determined as belonging to this species, it became evident that an important character had been overlooked. Most of the mature spikelets of the type specimen did not show the capillary, tortuous upper part of the awn of the lemma. A detailed description of this awn is therefore included in the preceding paragraph.

TYPE AND LOCALITY: "Type in the herbarium of the University of Michigan, duplicate type in the U. S. National Herbarium, collected by H. H. Bartlett, no. *17235*, Dec. 6, 1940, grassland at Del Monte, Bukidnon, Mindanao Island, Philippines."

PHILIPPINES: (Philip. Bur. Sci. Herb. *13983*, no collector nor locality given) (NH); *Loher 7185*, no locality (NH); Luzon: Ilocos Norte Province, *Merritt & Darling* (Philip. Bur. For. *15517*), Nov. 1908 (NH, NY); Cagayan Province, *Ramos* (Philip. Bur. Sci. *13983*), Feb. 1912 (NH); *Curran* (Philip. Bur. For. *16842*), Mar. 1909 (NH); Mountain Province, Bontoc, Bauco, *Vanoverbergh 4005*, Dec. 1915 (NH); Benguet, *Ramos* (Philip. Bur. Sci. *5319*), Dec. 1908 (NH, NY); Zambales Province, Mt. Tapolao, *Ramos & Edaño* (Philip. Bur. Sci. *44721*), Nov.–Dec. 1924 (NH, NY); Pampanga Province, Mt. Arayat, *Clemens 16211*, Oct. 31, 1925 (NY); *Merrill 3903*, Oct. 1904 (NH, NY); Bulacan Province, *Ramos 1933*, Dec. 1914 (NY, G); Bataan Province, Mt. Mariveles, *Merrill* (Kneucker, Gram. Exsic. *744*), Dec. 12, 1908 (G); *Elmer 6989*, Nov. 1904 (NY); *Williams 236*, Nov. 27, 1903 (NH, NY); Rizal Province, *Ramos 596*, Nov. 1910 (NH); *Ramos* (Philip. Bur. Sci. *24081*), Dec. 1915 (NH, NY, G); Mt. Irid, *Ramos & Edaño* (Philip. Bur. Sci. *48501*), Nov. 1926 (NH, NY); San Andales, *Edaño* (Philip. Bur. Sci. *48733*), Dec. 1926 (NY); Montalban, *Merrill 6237*, Nov. 1908 (NH, NY); Tayabas Province, Guinayanan, *Escritor* (Philip. Bur. Sci. *20904*), Mar.–Apr. 1913 (NH, NY); Albay Province, Mayon volcano, *Ramos & Edaño* (Philip. Bur. Sci. *75748*), Sept. 1928 (NY); Catanduanes Island, *Ramos & Edaño* (Philip. Bur. Sci. *75257*), Jul.–Sept. 1928 (NY); Sorsogon Province, Mt. Bulusan, Irosin, in soil among rocks of light shaded woods along upper edge of Sibulan River falls, alt. 2750 ft., *Elmer 16633*, July 1916 (NH, NY, G); Visayan Islands:

Island of Leyte, *Menzel 1519,* July 28, 1915 (NY, G); Island of Bohol, *Ramos* (Phil'p. Bur. Sci. *42880*), Aug.–Oct. 1923 (NH); Mindanao: Bukidnon Province, grassland at Del Monte, *Bartlett 17235,* Dec. 6, 1940 (UM, TYPE; NH, isotype); Davao Province, Mt. Apo, Todaya, *Elmer 11773,* Sept. 1909 (NH); Todaya, in dry rather stony soil of a wooded ridge, alt. 2000 ft., near Sibulan River, *Elmer 11298,* Aug. 1909 (NH, NY); Zamboanga Province, *Merrill 5484,* Oct. 10, 1906 (NH).

7. **Garnotia mutica** (Munro) Druce, Rep. Bot. Soc. Exch. Club **1916:** 624. 1917. Later combination with the same basis, *G. mutica* (Munro) Janowski in Mez, Repert. Sp. Nov. **17:** 86. 1921.

Berghausia mutica Munro, Proc. Amer. Acad. **4:** 362. 1860.

Garnotia tectorum Hook. f. Fl. Brit. Ind. **7:** 242. 1896. Described from Ceylon.

Garnotia patula Munro var. *mutica* Rendle ex Forbes & Hemsley, Jour. Linn. Soc. Bot. **36:** 387. 1904. Based on *Berghausia mutica* Munro.

Perennial; culms 30–40 cm. tall, erect, simple, glabrous, the nodes pubescent; blades mostly basal; sheaths glabrous, longer than the internodes; collar pubescent; ligule membranous, the margins minutely erose, ciliolate; blades elongate, 25–50 cm. long, 4–6 mm. wide, flat, glabrous or the upper surface with a few, long, widely distributed, papillose-base hairs, the base of the blade densely pubescent with short and long hairs intermixed, the nerves and margins scaberulous; panicles about 32 cm. long, the branches slender, up to 11 cm. long, ascending to spreading, in distant fascicles of 3's, or those toward the summit paired to solitary; spikelets dorsally compressed, 4.5–5.5 mm. long, about 0.8 mm. wide, lanceolate to narrow-lanceolate, bearded around the base, in distant pairs, one pedicel short, the other about as long as the spikelet; glumes equal to subequal, the nerves scaberulous, the tips acuminate, awnless or the first glume mucronate; mature lemma equaling the glumes, short-stipitate, acuminate, awnless, glabrous, 3-nerved; palea shorter than the lemma, the margins auricled toward the base, sparsely soft-pubescent from above the auricles to the tip; lodicules cuneate, glabrous.

TYPE AND LOCALITY: "Hong Kong." Collected by Charles Wright (U. S. North Pac. Expl. Exped. 1853–56). Collector's number not indicated.

CHINA: Kwangtung: Hongkong, *C. Wright* (U. S. North Pac. Expl. Exped. 1853–56) (NH, G, ISOTYPES).

8. **Garnotia philippinensis** sp. nov. FIG. 1.

Perennis; culmi 35–55 cm. alti, erecti, simplices, nodis pubescentibus; vaginae glabrae vel sparse pilosae, collari dense pubescente; laminae 10–30 cm. longae, 3–8 mm. latae; paniculae circa 20 cm. longae, angustae; spiculae 4–5 mm. longae, 0.5–0.7 mm. latae, basi breviter pubescentes; glumae acuminatae, muticae; lemma 1-nerve, acuminatum, muticum.

Perennial; culms 35–55 cm. tall, erect, simple, glabrous, the nodes pubescent; sheaths longer than the internodes, those near the base sometimes sparsely pilose, the upper glabrous or the throat with few long hairs; collar densely pubescent; ligule about 0.2 mm. long, minutely erose, ciliolate; blades of the basal leaves reduced, those of the upper 10–30 cm. long, 3–8 mm. wide, linear-lanceolate, acuminate, the upper surface with short, sparse pubescence toward the tip, the base densely pubescent with short hairs mixed with a few long ones, the rest of the blade glabrous, the nerves and margins scaberulous; panicles about 20 cm. long, narrow, conspicuously interrupted toward the base, the branches weakly scabrous, usually appressed, up to 4 cm. long; spikelets dorsally compressed, 4–5 mm. long,

0.5–0.7 mm. wide, narrow-lanceolate, short-pubescent at the base, in pairs, the pedicels short, unequal; first glume as long as the spikelet, acuminate; second glume usually shorter than the first, acute to acuminate, the mid-nerve running along a prominent, longitudinal, median depression, both glumes awnless, scaberulous on the nerves, sparsely puberulent on the internerves; lemma narrow-lanceolate, glabrous, 1-nerved, acuminate, awnless; palea shorter than the lemma, the margins auricled toward the base, sparsely pubescent from the auricles to the tip; lodicules spatulate-cuneate, glabrous.

TYPE in the U. S. National Herbarium (Philip. Bur. Sci. no. *42963*), collected from the Island of Bohol, Visayan Islands, Philippines, Aug.–Oct., 1923, by Maximo Ramos.

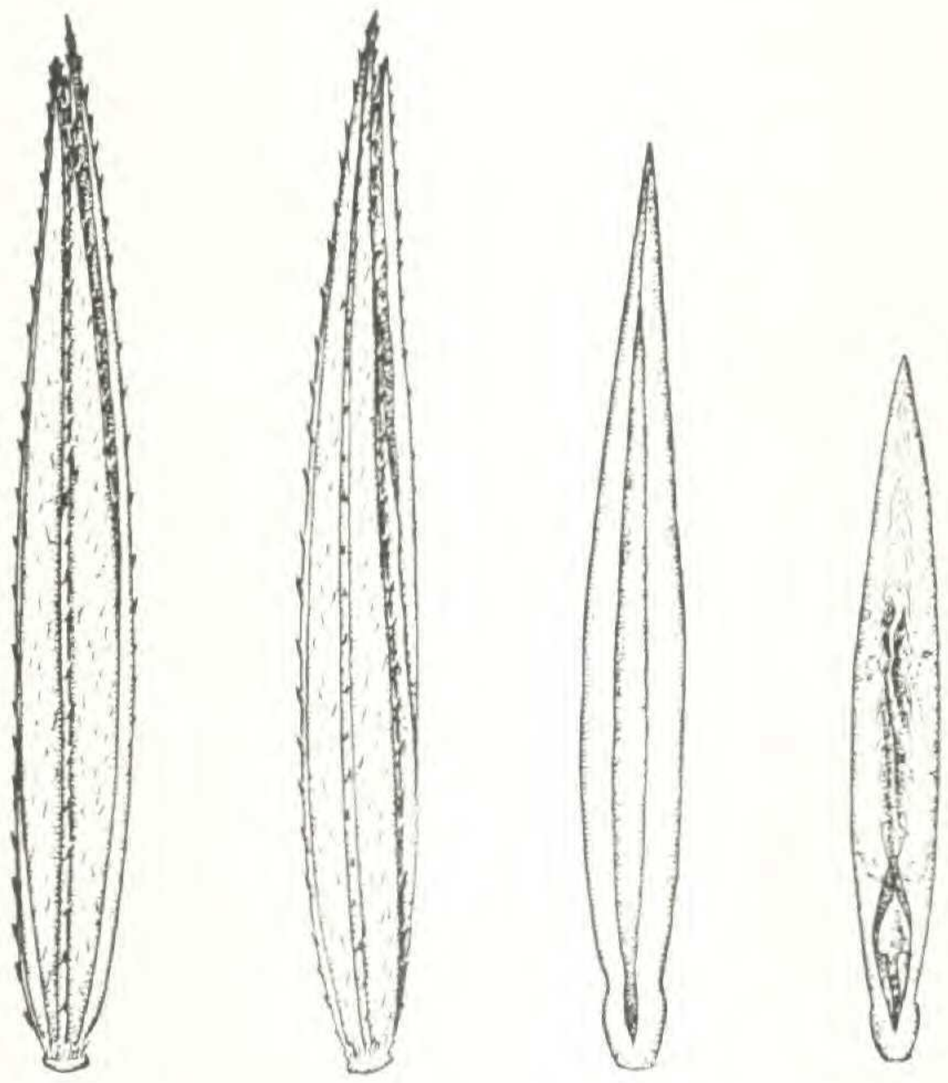

FIG. 1. *Garnotia philippinensis* Santos, drawn from the type deposited in the U. S. National Herbarium (Philip. Bur. Sci. no. *42963*): *a*. and *b*. ventral and dorsal views of the spikelet respectively; *c*. lemma; *d*. palea (*a-d*, × 14).

This species is distinguished from all Philippine forms of *Garnotia* in having awnless spikelets. The habit of the plant and the structure of the spikelet suggest *Garnotia mutica* (Munro) Druce, of Hongkong, from which the new species differs in the absence of long, tuberculate-base hairs, which are very sparsely distributed along the entire length of the blades in *G. mutica,* and in having a narrow panicle with branches not more than 4 cm. long, the spikelets approximate, as many as 10 pairs along the appressed branches.

EXPLANATION OF PLATES

All figures are drawn from types deposited in the U. S. National Herbarium.

PLATE I

Garnotia fragilis Santos (*Pételot 4745*): *a*. habit, × ½; *b*. inflorescence, × ½; *c*. spikelets, × 14; *d*. lemma, × 14.

PLATE II

Garnotia caespitosa Santos (*Gates 6237*): *a*. habit, × ½; *b*. ligule and adjacent parts, × 5; *c*. and *d*. dorsal and ventral views of the spikelet respectively; *e*. lemma (*c-e*, × 14).

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